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ABSTRACT

This paper reports an action research in a mix-ability P5 EM2 class in a Singaporean primary school. The general purpose of the action research is to explore how to implement journal writing effectively in primary mathematics classrooms in the context of Singaporean educational system. The paper offers a relatively comprehensive description of the action research, including its background, objectives, procedure, the actual tasks used, and students' evaluation of journal writing. Drawing on the pupils' feedback and the teacher's experience from the action research, the paper also reports the advantages of journal writing and then provides specific suggestions on how to implement journal writing in the teaching of mathematics. (Author)

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EXPLORING HOW TO IMPLEMENT JOURNAL WRITING EFFECTIVELY IN PRIMARY MATHEMATICS IN SINGAPORE

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Abstract: This paper reports an action research in a mix-ability P5 EM2 class in a Singaporean primary school. The general purpose of the action research is to explore how to implement journal writing effectively in primary mathematics classrooms in the context of Singaporean educational system. The paper offers a relatively comprehensive description of the action research, including its background, objectives, procedure, the actual tasks used, and students' evaluation of journal writing. Drawing on the pupils' feedback and the teacher's experience from the action research, the paper also reports the advantages of journal writing and then provides specific suggestions on how to implement journal writing in the teaching of mathematics.

Origin of the Study

According to *The School Excellence Model: A Guide* (SEM), an important policy document released by the Singapore's Ministry of Education (MOE), for a school to be successfully working, it has to "keep a finger on the pulse of the environment, both internal and external, leveraging the knowledge gathered, develop its capacity to achieve and sustain outstanding results for its stakeholders" (see SEM, Introduction)

Our students are our stakeholders. The SEM document has made it clear that our strategic planning depends very much on the findings of analysis of internal data, such as student's needs, talents and expectations (Criterion 2.1). When we monitor the well–being of students we would include the use of student feedback to improve the school programmes, and moreover, building good relations with our students would include providing an easy access for students to give feedback and information (Criterion 5.1).

As teachers, we all know the importance of having students' feedback and information to our teaching. However, the problem is, how to effectively get them? This issue was addressed in an inservice course with a main component being on alternative assessment, conducted by the second author and attended by the first author of this paper at the National Institute of Education, Singapore (for more information about the inservice course, see Fan, 2001). The question if and how journal writing as an alternative assessment can be effectively implemented in the context of Singapore's primary mathematics classroom was raised and this action research was thus collaboratively initiated.

Issues and Objectives of the Study

After we decided to conduct this action research, we discussed how to integrate journal writing into the mathematics programme in a local primary school in Singapore.

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Many questions on action needed to be addressed. As students in that school already started writing their English journals and Science learning logs, and mathematics teachers usually also teach English and/or science subjects, would another type of journal writing take up more marking time from teachers? At which grade level should teachers ask students to do math journal writing? What should we ask the pupils to write about? How often should journal writing be done? Should the students write it at home? Would they be writing individually, in pairs or a group? And if they write in school, would we be sacrificing teaching time? What follow–up actions should teachers take after reading students' journals?

In short, the objectives of this action research were, in general, to explore ways on how to implement Journal writing effectively in the primary mathematics classroom in Singapore, and in specific, to see whether journal writing should be integrated into the mathematics programme offered in that primary school, and if so, then what kind of support and suggestions should be given to the mathematics teachers in the department.

School and Class Background

Students in the school came from around the neighbourhood, with 11.2% living in 1–3 roomed flats, 30% living in 4–5 roomed and executive flats and 23% living in private or HUDC homes.

Regarding students' parent educational background, 53.6% of the parents are University graduates, 21.8% have Polytechnic Diplomas and GCE 'A' level Certificates, 23.1 % have up to Secondary or ITE level of education, and 1.4% have primary education. The main language used at home is English.

The school is a nationally high performing school with a large size of student population. Its students always performed very well in the Primary School Leaving Certificate Examination (PSLE).

The class chosen is a primary 5, EM2, mixed–ability class with 36 students. It is considered the 'weakest' of all the eight P5 classes. The pupils are generally weak in mathematics. There are seven pupils who should have been in EM3 with three of them being Dyslexics.

By the way, three mathematics teachers in the school also joined the effort in this initiative, and they also tried journal writing in three other classes they were teaching: one each at P6 (the weakest EM2 mixed-ability class), P5 (an EM1 higher-ability class), and P2 (an mixed-ability class). However, to keep it more focused, the data presented here were mainly based on our structured study with the pupils in the P5 EM2 class.

Process of Implementation

Like many other action researches, this study also took a gradual and relatively flexible process with much attention being given to the practical need of teaching and learning, and to the ongoing improvement (e.g., see Elliott, 1991; Hitchcock & Hughes, 1995; Kemmis, 1997).

At the beginning of the school year, the involved teachers had a briefing on the use of journal writing in mathematics classrooms. It was felt that mathematics journal writing would be a new experience for the pupils, and hence the pupils needed to be tuned to the teaching–style employed and a comfort zone needed to be established where pupils would be in rapport with teachers under the new teaching strategy and be able to communicate mathematics with the teacher freely and confidently. Therefore, in the initial stage, the math journal was used as a learning log, that is, an extension of the math topic taught somehow like an enrichment activity.

Three earlier tasks were used for the above purpose, the first two in School Term 1 and the third in Term 2. The first task was given after the pupils were introduced to two math topics in the curriculum: first Prime Numbers, and then Whole Numbers. In the task, the pupils were asked to find out which numbers are Prime numbers based on the fact that it cannot be divisible other than by itself and the number 1. The results showed that pupils were interested in the tasks but their response was not that great. It was felt they were probably wondering when the real mathematics would come in, when they would be learning about place values, and so on.

The second task required the pupils to collect advertisements on homes for sale while they were still learning the topic of numbers. The focus was on the HDB flats. With the newspaper cuttings, the whole class tabulated the information gathered and looked for relationship between number of rooms, location and price of the flat. The purpose was to get the pupils to arrive at the possible actual prices based on the rounded–up figures given in the advertisements.

The second task was not quite successful as pupils were not forthcoming with ideas and opinions. The activity was very much teacher-directed and some of the pupils came to class without the newspaper cuttings. It was concluded that they were not used to situations where they and not the teacher make conclusions, therefore more attention needed to be paid to this problem.

For the third task, the pupils were learning about graphs, so they were asked to collect different types of graphs from the newspaper. The results showed that most pupils collected graphs on the stock market such as Hang Seng Index, Straits Time Index, etc. They then answered questions based on their graphs – highest point, lowest point, what the graph was about, and so on.

This task was better received and by then rapport had been established. The pupils were already into English Journal writing and had understood that communication through the Journal is based on trust, facts and that there is confidentiality.

A major review of the process took place after we tried the above three tasks in the earlier stage. The two authors met and discussed the future plan. Given the previous experience, the authors decided to take a more formal and intensive way to proceed with the study. It was also established that because the study aimed to explore with the

implementation of math journal in the classroom, the tasks given should be varied with specific theme for every task. Below were these themes chosen.

a) to find out the pupils' understanding of a topic taught and justify answers,
b) to find out pupils' disposition towards math and math learning at the end of 2001,
c) to find out pupils' disposition towards higher order thinking questions,
d) to get pupils to find out more about a topic, and
e) to get pupils to keep a record of the math activity.

Although journal writing is usually done by individual pupils, in this study, two tasks were done as group discussions. The reasons were firstly to include collaboration in the activity and secondly, to use the activity to help the weaker ones check on their own understanding of the topic, through the discussion that would take place.

The following are the math journal tasks given to the pupils in the third and fourth school terms. A brief explanation for each task was included in the brackets.

1. We have done Average. Your friend missed the lessons on Average. How would you explain Average to him?

(This task was given after the topic was taught. It was to find out how much the pupils know about Average.)

2. Your teacher has taught you percentage of a quantity, e.g. 30% of 500. Your friend is not sure of the methods shown by your teacher to arrive at the answer. Because your teacher wants to go on to teach average, she asked you to explain to your friend the different methods that can be used to calculate the percentage of a quantity. How would you help your friend?

(This was given after Percentage and Average was taught. The pupils could not grasp percentage very well and the topic was revisited even though they were already learning Average. This activity was very specific. The outcome was that pupils would be able to show 3 different ways of arriving at the answer.)

3. (Pupils were given an activity worksheet.) Think about the task. How did you solve the problem?

(This was given to find out whether the pupils are interested in such questions given in the worksheet and whether they would persevere. Parental involvement was most welcomed as this was done at home)

4. You have learnt about triangles and properties of triangles. Imagine that your friend gives you a cut out of a triangle. Your friend says, "Can you help me identify this triangle?" How will you help him?

(This was given after the topic was taught. It was a way to check whether the teaching method used was effective. The lesson was done on Powerpoint created by Graham.)

5. What is Tessellation?

(Tessellation was taught using the website comath.com. And later pupils were showed what pupils in a school in the USA had created. No explanation was given. Pupils read and took down notes. The pupils were to take charge of their own learning of the topic by doing a bit of research on Tessellation.)

6. Recording math activity (that we did in this week).

(The pupils were to record and reflect on what happened in class the whole week that Tessellation was being taught.)

7. You have learnt about volume. There are many words related to volume. Look at the list of words below and write what they mean, in relation to volume.

length, volume of water, cuboid, breadth, height, difference in height, a tank is $\frac{2}{5}$ filled, volume of container, base area, cube.

(This was done as a group activity. The pupils were a bit confused as to what was wanted. They sought clarification and went on to complete their task.)

8. Mathematics and Me in 2001.

(This topic was given after the Math SA2 paper. It was to find out their disposition about mathematics and what they would like in a math lesson.)

Although the earlier three tasks in the first two school terms were done in a regular exercise book as a transitional measure, the above eight tasks were done in worksheets (template) which were specially provided for pupils to write their mathematics journal work. Handling such worksheets is a lot easier as they can be easily carried home for the teacher to study the pupils' response. For the worksheets, the pupils were usually asked to write them in the class within 20 minutes. But if they could not complete the task in class, they were allowed to take it home. Group tasks were required

to be completed in class within 20–30 minutes. All the tasks were given after corresponding topics were taught and they were spread out in the third and fourth school terms.

At the end of the school year, a special journal was given to all the pupils, that is, they were asked to answer a survey on journal writing – an evaluation of the experience they have gone through from students' perspective.

Findings and Suggestions from the Study

Now we shall report the main findings from this study and then make some practical suggestions for the implementation of journal writing in primary mathematics classrooms.

According to the students' evaluation on the survey carried out, 76.7% of them know why they've been asked to write on the journal topics. Some of the reasons mentioned included that she (the teacher) wants to make sure we understand what's on the board, she wants to see whether we have understood what has been taught, she wants to know more about us, and she wants to know what we think about Math. It seems to us that journal writing helped the pupils and the teachers understood each other well, which is important in the teaching of mathematics.

The results also show that 66.7% of the pupils on survey reported that they like writing about the topics, and 73.3% felt that the topics were interesting. The results suggest that pupils in general can accept the challenge of this new type of learning activity. In addition, 40% wanted to write journal in P6, 40% did not have a certain opinion, and 20% did not want to continue at P6. For those 20%, we think that one possible reason might be that they are more concerned with the PSLE exam in P6, which has great pressure on pupils and needs them to take much time to prepare for.

In the survey, 53.3% of the pupils expressed that "they ware sure they can tell their teacher how they really feel about math through the journal." On what they like about math journal, pupils listed the following, among others, "fun to write", "can tell teacher whether we understand the topic", "read it later to improve English", "refresh memory", "share problems", and "revise". In contrast, on what they don't like about math journal, they identified the following: "too little time to write", "don't know how to give examples", "must think fast", "too few math journal compared to English", "boring", and "don't know how to teach some of the topics". These feedbacks are very meaningful for us to further improve the implementation of journal writing in classrooms.

The pupils also gave their suggestions for improvement, which include "write during holidays", "give easier topics", "write about the homework given", and "do more".

Another important practical issue is, how frequently should journal writing be done in mathematics teaching? In the survey, 33.3% of the pupils suggested it should be once a week, 20% felt it should be after every topic. The rest are divided among

everyday, twice a month, twice a week, 2–3 times a week and fortnightly. The results are somehow surprising, though also encouraging, as we previously thought that the frequency should be about one journal task for every two to four weeks.

Taking into account the whole process of this study, we think that various journal writing tasks and students' responses provided the following advantages for the teacher in the teaching of mathematics.

- The teacher was able to know better on a pupil's understanding of a topic through journal writing, and then could then re-teach or zoom in on the pupil to correct his misconception if necessary.

- The teacher could effectively receive feedback on her teaching. For example, some of the pupils commented in their journals that humour in mathematics was very welcome. One pupil who is Dyslexic indicated: "She makes jokes and she said funny things about math while teaching us, that is how I can learn things easier". Using this specific feedback, the teacher understood better how to motivate pupils in her class.

- The teacher could find out though pupils' journal writing how they responded to "Math Challenges" problems and know whether they would persevere, and even if it could take a pupil up to 2 hours to look for a solution.

- The teacher gets an insight into the pupils' perception of their mathematics ability. For example, the teacher was able to know from journals that some pupils felt that they had improved in their attitudes towards math, compared to last year.

- The teacher was able to know more specifically how best a pupil can learn from his entry in his math journal. For example, one average pupil wrote: "sometimes if it is too hard I can't even think of anything. I will get very distracted so in class I would like to be alone away from anybody or else I will talk to them and maybe just maybe I will learn a little bit more if I am alone.". The information was useful for the teacher to help the pupil in learning mathematics.

Based on the data collected from pupils' journal entries, their responses to the survey, the teacher's fieldnotes, and our personal experience and reflection over the process of this study, we would like to make the following suggestions on how to implement journal writing in primary mathematics classrooms.

1. **Establishing a conducive environment is important.** Math journal writing would be a new experience for the pupils at the beginning. It is very much different not only from the traditional mathematics problems and exercises that pupils have been used to, but also from the English Journal as the pupils would have to be specific in their response to the question and mathematical facts are sometimes needed. The pupils must

see the value of journal writing, and hence it is necessary "for the teacher to explain to students about the importance and usefulness of their writing" (Fan & Yeo, 2000). They have to see the journal as a way for the teacher to help them improve in math. For tasks related to the affective domain, the pupils must understand that the emphasis is on how they actually feel and not to write things just to please the teacher. Moreover, journal writing requires teachers and pupils to have rapport with mutual trust, respect and confidence.

2. **The tasks given should be varied but each with a specific purpose**. Although there are no fixed rules about what should be in the journal, journal writing should not be treated as just another composition to be marked but as a tool to serve the purpose of teaching and learning. A useful guideline would be for the teacher to be clear of her own objectives for each task given. Math journal can be used as an internal scan to help teachers improve on the teaching and learning process.

A good example in this aspect can be found in Swindal (2000), who showed how a pupil recorded what she has learnt at the Geometry Workstation in her journal. In this study, we also found that the pupils like the way in which a scenario is put to them. This is more appealing than just asking, "Write all you know about triangles". Scenarios would also mean that ambiguity is cut down and pupils can focus on what is asked instead of seeking clarification.

3. **Time on task would depend on the tasks given**. A short recap of what had been taught can take 20 minutes. But a running record of what had gone on in the classroom can take a few days.

4. **Journal writing can be done as group work or individually**. While it has been often assumed that journal writing is individual work. The study showed that both ways have their merits, depending on the task and purpose.

5. **Journal writing can start at latest at primary four**. At this stage, pupils would be able to express their thoughts with little help from the teacher. By the way, it is interesting to note that one of the staff members in the school, who is currently teaching a P2 class, has been trying to get her pupils to write, being starting from what they have learned about fractions, though this task was given towards the end of the year and the pupils have been writing short accounts.

6. **Journal writing can be done once a week and after every topic**. Ultimately, the teacher of the class would like her pupils to reflect on their math learning every week, even if a task is not given. The students in the class had reached a stage where they automatically make entries into their English journal every weekend and reflect on the week's events. If they can do that for the math journal, then it would seem that they are in control of their learning and the feedback would be very valuable to the teacher.

7. **For the math journal to be effective, pupils' entries must be read immediately** so that remediation or re-teaching can be carried out without delay.

Concluding Remarks

This action research has made us believe that journal writing can indeed be a good avenue for primary students to provide feedback on school programmes and express their needs in terms of mathematics teaching and learning. For the teachers, the journal allows us to gather information on our pupils, monitor their understanding of the topic (other than paper and pencil) and most importantly, it brings us closer to our pupils. The math journal is where the teacher and the pupil come together on a common platform to make the link between teaching and learning.

The study also shows that math journal is not just for the better classes. The pupils involved in the study do not have a strong command of the English language (the class average score for English at SA1 was 51 and SA2 was 63), but they have gotten around it by drawing diagrams. After all, it is mathematics.

Finally, like all new things different from conventional, implementing journal writing in mathematics teaching as a new initiative would take a tremendous effort. As teachers, we have to plan what we want to find out and the pupils have to feel comfortable enough to provide the information. But it is vital information that can help us improve on our programmes to provide the best for our stakeholders: the pupils.

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